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SOUTHEASTERN FOREST EXPERIMENT STATION

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LOGGING AND MILLING STUDIES IN THE SOUTHERN APPALACHIAN REGION
PART IV.—COSTS AND RETURNS

By

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This note is the last in a series of four technical notes describing the results of logging and milling cost and yield analyses of hardwoods in the Southern Appalachian region. Its function is to compare costs and returns under a variety of conditions with the purpose of providing an equitable basis for stumpage appraisal and of indicating the margins available for stumpage and profit or loss by log and tree sizes.

Logging studies were made during the course of a cutting operation on the Bent Creek Experimental Forest near Asheville, North Carolina, in the latter part of 1945 and early 1946. The saw timber volume marked for cutting was 525 M bd. ft., nearly all of it included within various oak types. Elevations ranged from 2800 to 3750 feet; skidding slopes varied up to 100 percent, but averaged 30 percent. Saw timber volume per acre of operable area averaged 5.1 M bd. ft. before cutting, but by using 18 inches as a rough cutting limit, 74 percent of the total merchantable volume was removed.

The felling and bucking analysis was based on two 2-man crews (or an occasional 3-man crew) using ax and crosscut saw. The skidding analysis was based on the use of two teams of horses, two teamsters, occasionally a grabjack, and such swamping labor as was necessary to clear skid trails and to prepare log landings. Loading was done with one man operating a machine loader[1/] and assisted by two truck drivers. Hauling was done with two 1-1/2 ton trucks and trailers. The road system included a woods road 0.9 mile long, a graded gravel road 5.9 miles

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1/ Tongs, attached to a 150-foot cable, were suspended from an A-pole frame. Power was furnished by an old automobile engine.

long, and 11.6 miles of asphalt highway to the mill where the logs were sawed. In unloading, the two truck drivers worked together, first unloading one truck, then the other.

Sawmilling was done at a No. 7 Wheeland stationary mill, powered with a new Murphy Diesel engine of 150 horsepower. The mill was equipped with a circular headsaw, usually 48 inches in diameter, a gang edger (3 saws), a trimmer (2 saws), a swing cutoff saw, and a small skidder for hauling logs from the yard to the deck. The mill was operated by seven men[2/] in addition to two men employed in the yard piling lumber.

Costs for the various operations from felling and bucking to lumber piling were determined from actual records and then adjusted to conform to a more fully utilized work week. In this technical note, only adjusted costs are used. They assume a 40-hour work week 50 weeks a year (or 8 hours a day for 250 days a year) for all operations except loading, hauling, and unloading. Adjusted costs of the latter operations are based on 9-1/2 hours rather than 8 hours in order to permit two hauling trips each operational day. It should be emphasized that the adjusted costs used are based on a standardized work period; they do not assume any improvement in the efficiency of work output.

Lumber yields of logs and trees were analyzed for 18 hardwood species. Ash, chestnut, black gum, hickory, red maple, black oak, chestnut oak, northern red oak, scarlet oak, white oak, and yellow-poplar came predominantly from the Bent Creek Experimental Forest. Basswood, beech, black birch, buckeye, black cherry, cucumber magnolia, and sugar maple came almost exclusively from the Big Ivy Working Circle of the Pisgah National Forest, 24 miles from Asheville.[3/] For the Big Ivy species, separate studies were made only of sawmilling costs and lumber yields; the logging costs used were those determined at Bent Creek.

To calculate lumber value yields, analyses were made of lumber grade-yields of logs and trees, lumber thicknesses, and overrun or underrun; and these data were related to the OPA green lumber price ceilings in force on May 7, 1946. The calculated lumber value yields

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[2/] The seven men included a sawyer, dog setter, edgerman, trimmerman, cut-off sawyer, lumber sorter, and log yardman.

[3/] The Big Ivy cutting area was predominantly of cove hardwood types but contained large proportions of oak-chestnut and northern hardwood types. Elevations and slopes were similar to those encountered on the Bent Creek Experimental Forest. Saw timber volume per acre of operable area was 9.7 M bd. ft., of which 6.6 M bd. ft. was marked for cutting.

for species and log grades were presented by log diameter and tree diameter classes in Technical Note No. 64. Value yields were expressed on both a mill tally and log scale basis.

Before comparing costs and returns, a new set of cost calculations is necessary. The cost analysis presented in Technical Note No. 62 needs to be related to the time studies presented in Technical Note No. 63. The adjusted hauling cost of $7.07 per M bd. ft., gross log scale, the unloading cost of $0.30 per M bd. ft., and the lumber yard costs of $3.53 per M bd. ft. need no further treatment because they apply to all sizes of logs and trees. But for felling and bucking, skidding, loading, and sawmilling, hourly costs of operation must be applied to the time required per unit of volume output to show the variation in costs with log and tree sizes. E.g., felling and bucking time for 20-inch trees containing two 16-foot logs was given as 274 man-minutes per M bd. ft. in table 1 of Technical Note No. 63. In Technical Note No. 62 adjusted hourly cost of felling and bucking was shown to be $0.76 per man-hour, which is equivalent to $0.01267 per man-minute of operation. Applying the latter rate to 274 man-minutes, a cost of $3.47 per M bd. ft. is obtained, which is the cost shown in table 1 of this note.

Calculated costs per unit of volume by log and tree sizes are shown in tables 1 to 10. Table 11 is a summary of costs by tree diameter classes; table 12 is a summary of costs by log diameter classes.

Table 1.--Total felling and bucking cost per M bd. ft., gross log scale, by tree DBH class, log length, and number of logs per tree.

Tree DBH Class	1-Log Tree		2-Log Tree		3-Log Tree		Average Trees
	10-ft. logs	16-ft. logs	10-ft. logs	16-ft. logs	10-ft. logs	16-ft. logs	
14	$11.37	$7.21					$6.02
16	10.12	6.33	$7.31	$4.47			5.46
18	8.93	5.62	6.32	3.99			4.94
20	7.79	4.91	5.46	3.47	$4.80	$3.12	4.45
22	6.84	4.36	4.81	3.03	4.28	2.71	4.00
24	6.09	3.88	4.41	2.72	3.91	2.44	3.61
26	5.57	3.56	4.12	2.55	3.65	2.28	3.24
28	5.26	3.29	3.90	2.42	3.46	2.14	2.96
30	5.04	3.15	3.74	2.33	3.29	2.06	2.76
32	4.91	3.05	3.61	2.25	3.17	2.00	2.70
34	4.81	2.98	3.53	2.19	3.10	1.95	2.71
36	4.75	2.91	3.48	2.14	3.05	1.90	2.77
38	4.70	2.88	3.43	2.10	3.01	1.87	2.85
40	4.66	2.86	3.39	2.08	2.98	1.85	2.99
42	4.64	2.85	3.37	2.05	2.95	1.82	3.18
44	4.62	2.84	3.36	2.04	2.93	1.80	3.52

Table 2.--Total felling and bucking cost per M bd. ft., gross log scale, by log diameter class and log length.

Log diameter class	10-ft. logs	16-ft. logs	Average length logs
10	$ 6.60	$ 3.81	$ 6.17
12	5.76	3.46	5.17
14	5.12	3.18	4.37
16	4.64	2.89	3.80
18	4.29	2.66	3.42
20	4.04	2.48	3.14
22	3.81	2.33	2.94
24	3.61	2.23	2.79
26	3.46	2.17	2.70
28	3.33	2.13	2.63
30	3.23	2.09	2.58
32	3.15	2.06	2.55
34	3.10	2.05	2.51
36	3.07	2.04	2.48
38	3.04	2.03	2.47
40	3.03	2.01	2.46

Table 3.--Total skidding cost per M bd. ft., gross log scale, by tree diameter class, slope, distance, and log length

Tree DBH Class	ZERO SLOPE								
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet		
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs
14	$ 8.08	$ 4.98	$ 6.58	$17.56	$11.77	$14.36	$30.65	$20.60	$25.07
16	6.64	4.25	5.49	14.90	10.26	12.43	25.58	18.13	21.66
18	5.64	3.74	4.77	12.94	9.05	10.89	22.32	16.17	19.22
20	4.86	3.32	4.13	11.40	8.08	9.62	19.79	14.60	17.20
22	4.31	2.96	3.62	10.11	7.36	8.60	17.62	13.42	15.54
24	3.77	2.65	3.20	9.05	6.73	7.81	15.84	12.37	14.24
26	3.38	2.38	2.90	8.18	6.21	7.24	14.60	11.49	13.27
28	3.02	2.17	2.59	7.60	5.79	6.73	13.67	10.92	12.43
30	2.75	2.02	2.35	7.24	5.43	6.37	12.94	10.47	11.80
32	2.50	1.90	2.17	6.88	5.28	6.09	12.37	10.11	11.28
34	2.32	1.81	2.05	6.64	5.13	5.85	11.92	9.89	10.89
36	2.17	1.75	1.96	6.43	4.98	5.64	11.49	9.71	10.56
38	2.05	1.72	1.87	6.21	4.86	5.49	11.25	9.59	10.32
40	1.96	1.69	1.81	6.00	4.77	5.40	11.07	9.47	10.17
42	1.87	1.66	1.78	5.82	4.71	5.34	10.95	9.38	10.08
44	1.81	1.63	1.75	5.70	4.68	5.31	10.86	9.32	10.02

Table 3 (Continued).--Total skidding cost per M bd. ft., gross log scale, by tree diameter class, slope, distance, and log length

Tree DBH Class	20 PERCENT SLOPE								
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet		
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs
14	$ 9.05	$ 5.64	$ 7.09	$20.39	$13.79	$17.10	$34.18	$23.98	$28.81
16	7.24	4.77	5.91	17.29	12.16	14.96	29.32	21.51	25.37
18	6.06	4.10	5.07	15.08	10.89	13.09	25.70	19.64	22.78
20	5.19	3.56	4.40	13.21	9.89	11.64	23.05	18.04	20.72
22	4.56	3.20	3.89	11.80	9.05	10.53	20.88	16.68	18.85
24	4.04	2.90	3.47	10.68	8.39	9.68	19.13	15.54	17.41
26	3.62	2.65	3.17	9.89	7.81	8.96	17.62	14.66	16.32
28	3.32	2.44	2.90	9.26	7.45	8.39	16.56	13.94	15.39
30	3.11	2.32	2.68	8.75	7.15	7.96	15.81	13.42	14.72
32	2.96	2.20	2.53	8.33	6.88	7.72	15.23	12.94	14.15
34	2.81	2.11	2.41	8.02	6.73	7.51	14.75	12.64	13.73
36	2.65	2.05	2.32	7.81	6.58	7.30	14.36	12.37	13.36
38	2.53	1.99	2.23	7.69	6.49	7.15	14.09	12.16	13.12
40	2.44	1.96	2.17	7.60	6.43	7.06	13.94	11.98	12.94
42	2.38	1.93	2.14	7.54	6.40	7.00	13.85	11.83	12.79
44	2.35	1.90	2.11	7.48	6.37	6.97	13.79	11.70	12.70

Table 3 (Continued).--Total skidding cost per M bd. ft., gross log scale, by tree diameter class, slope, distance, and log length

Tree DBH Class	40 PERCENT SLOPE								
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet		
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs
14	$ 9.32	$ 6.00	$ 7.66	$22.02	$15.48	$18.58	$37.07	$26.94	$31.74
16	7.57	5.22	6.49	18.64	13.58	16.11	32.67	24.34	27.96
18	6.49	4.62	5.70	16.32	12.16	14.24	29.02	22.26	25.16
20	5.70	4.13	4.98	14.36	11.07	12.70	25.85	20.66	22.99
22	4.98	3.74	4.40	12.85	10.20	11.43	23.20	19.22	21.18
24	4.46	3.38	3.92	11.70	9.47	10.62	21.33	18.04	19.67
26	4.01	3.11	3.56	10.92	9.02	9.96	19.88	17.13	18.49
28	3.68	2.90	3.32	10.32	8.60	9.47	18.76	16.47	17.62
30	3.41	2.68	3.11	9.83	8.33	9.11	17.86	15.90	16.89
32	3.26	2.56	2.96	9.44	8.08	8.81	17.35	15.48	16.38
34	3.11	2.47	2.84	9.17	7.87	8.54	16.92	15.17	16.08
36	3.05	2.41	2.75	8.96	7.72	8.33	16.68	14.93	15.81
38	2.99	2.35	2.68	8.81	7.60	8.15	16.47	14.78	15.60
40	2.96	2.32	2.65	8.69	7.51	8.02	16.32	14.69	15.45
42	2.93	2.29	2.62	8.63	7.45	7.96	16.23	14.63	15.35
44	2.90	2.26	2.59	8.60	7.42	7.90	16.17	14.60	15.29

Table 3 (Continued).--Total skidding cost per M bd. ft., gross log scale, by tree diameter class, slope, distance, and log length

Tree DBH Class	60 PERCENT SLOPE									Average slope, distance, & log length
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet			
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	
14	$9.89	$6.37	$7.87	$23.47	$16.47	$19.67	$39.46	$30.05	$34.45	$9.68
16	7.96	5.55	6.79	19.64	14.51	17.10	34.45	27.18	30.62	8.08
18	6.85	4.86	5.91	17.13	13.15	15.23	30.83	25.01	27.75	7.06
20	5.91	4.34	5.19	15.39	12.01	13.73	28.12	23.20	25.52	6.21
22	5.22	3.92	4.56	13.94	11.19	12.43	25.73	21.66	23.71	5.55
24	4.62	3.56	4.13	12.73	10.53	11.61	23.77	20.21	22.11	5.04
26	4.13	3.26	3.77	11.86	9.99	10.92	22.26	19.28	20.82	4.68
28	3.83	3.05	3.47	11.19	9.59	10.35	21.09	18.43	19.85	4.40
30	3.56	2.90	3.26	10.62	9.29	9.96	20.21	17.86	19.01	4.19
32	3.41	2.81	3.11	10.26	9.02	9.59	19.43	17.38	18.40	3.98
34	3.26	2.72	3.02	9.96	8.81	9.32	18.79	16.98	17.86	3.83
36	3.17	2.65	2.93	9.71	8.60	9.17	18.34	16.62	17.41	3.74
38	3.08	2.59	2.84	9.53	8.48	9.05	17.92	16.38	17.10	3.68
40	3.02	2.53	2.78	9.38	8.39	8.96	17.62	16.17	16.83	3.62
42	2.99	2.50	2.72	9.29	8.33	8.90	17.41	16.02	16.62	3.59
44	2.96	2.47	2.68	9.23	8.30	8.87	17.26	15.90	16.47	3.56

Table 4.--Total skidding cost per M bd. ft., gross log scale, by log diameter class, slope, distance, and log length

Log Diameter Class	ZERO SLOPE								
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet		
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs
10	$9.53	$5.70	$8.02	$20.00	$12.64	$16.98	$33.94	$22.02	$29.08
12	6.67	4.34	5.70	14.66	10.11	12.70	25.37	17.86	22.11
14	5.22	3.53	4.40	11.80	8.51	10.26	20.60	15.39	17.98
16	4.19	2.96	3.53	9.96	7.45	8.54	17.62	13.58	15.32
18	3.53	2.59	3.02	8.54	6.73	7.45	15.54	12.28	13.48
20	3.05	2.29	2.59	7.66	6.12	6.73	13.73	11.25	12.34
22	2.68	2.05	2.32	7.00	5.64	6.21	12.85	10.53	11.40
24	2.44	1.87	2.11	6.46	5.28	5.79	12.01	9.83	10.62
26	2.23	1.75	1.96	6.06	4.98	5.49	11.28	9.32	10.14
28	2.08	1.66	1.81	5.73	4.71	5.22	10.71	8.96	9.74
30	1.96	1.57	1.69	5.43	4.49	4.98	10.20	8.60	9.38
32	1.84	1.48	1.60	5.19	4.34	4.77	9.74	8.30	9.02
34	1.72	1.39	1.51	4.98	4.19	4.56	9.32	8.02	8.66
36	1.60	1.30	1.42	4.77	4.04	4.40	8.96	7.78	8.30
38	1.51	1.24	1.36	4.56	3.92	4.25	8.60	7.57	8.02
40	1.45	1.18	1.30	4.34	3.83	4.10	8.30	7.42	7.78

Table 4 (Continued).--Total skidding cost per M bd. ft., gross log scale, by log diameter class, slope, distance, and log length

Log Diameter Class	20 PERCENT SLOPE								
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet		
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs
10	$10.11	$6.21	$8.51	$22.11	$14.66	$19.16	$38 22	$25.91	$33.24
12	7.00	4.83	6.12	17.86	11.92	14.66	29.11	21.24	25.91
14	5.58	3.92	4.77	13.58	10.35	11.92	24.19	18.76	21.75
16	4.68	3.32	3.92	11.64	9.05	10.26	20.97	16.83	18.76
18	3.92	2.90	3.38	10.11	8.30	9.17	18.76	15.32	16.92
20	3.41	2.65	3.02	9.05	7.66	8.30	16.83	14.36	15.54
22	3.02	2.41	2.72	8.30	7.15	7.75	15.54	13.58	14.51
24	2.75	2.23	2.47	7.78	6.73	7.27	14.51	12.85	13.73
26	2.59	2.08	2.32	7.36	6.43	6.94	13.88	12.28	12.97
28	2.44	1.96	2.17	7.00	6.21	6.67	13.45	11.80	12.85
30	2.32	1.87	2.05	6.70	6.00	5.43	13.06	11.43	12.43
32	2.20	1.78	1.96	6.49	5.85	6.21	12.70	11.13	12.01
34	2.08	1.69	1.87	6.34	5.70	6.00	12.34	10.86	11.61
36	1.96	1.60	1.78	6.18	5.55	5.79	11.98	10.62	11.25
38	1.87	1.54	1.72	6.03	5.40	5.70	11.61	10.41	10.92
40	1.78	1.51	1.60	5.91	5.25	5.55	11.25	10.20	10.62

Table 4 (Continued).--Total skidding cost per M bd. ft., gross log scale, by log diameter class, slope, distance, and log length

Log Diameter Class	40 PERCENT SLOPE								
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet		
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs
10	$10.62	$6.58	$8.96	$23.92	$16.26	$20.82	$41.84	$29.20	$36.74
12	7.51	5.19	6.52	18.13	13.58	16.26	32.28	24.74	29.29
14	5.94	4.25	5.13	15.02	11.70	13.30	27.09	21.69	24.28
16	4.92	3.74	4.34	12.94	10.47	11.61	23.71	19.55	21.36
18	4.19	3.26	3.77	11.40	9.59	10.35	20.97	18.07	19.46
20	3.74	2.96	3.32	10.32	8.93	9.53	19.16	16.86	18.07
22	3.32	2.68	3.02	9.62	8.39	8.90	17.86	15.99	16.89
24	3.05	2.47	2.81	9.08	7.90	8.51	17.01	15.32	16.08
26	2.90	2.35	2.65	8.69	7.57	8.18	16.44	14.78	15.48
28	2.78	2.26	2.53	8.42	7.30	7.87	15.99	14.39	15.05
30	2.65	2.17	2.41	8.15	7.09	7.60	15.54	14.00	14.66
32	2.53	2.08	2.29	7.87	6.94	7.39	15.08	13.64	14.27
34	2.41	1.99	2.17	7.66	6.79	7.18	14.66	13.27	13.91
36	2.29	1.93	2.08	7.45	6.64	7.00	14.24	12.97	13.54
38	2.17	1.87	1.99	7.24	6.52	6.82	13.82	12.73	13.18
40	2.08	1.81	1.93	7.06	6.43	6.64	13.45	12.52	12.82

Table 4 (Continued).--Total skidding cost per M bd. ft., gross log scale, by log diameter class, slope, distance, and log length

Log Diameter Class	60 PERCENT SLOPE									Average slope, distance, & log length
	Distance - 100 Feet			Distance - 400 Feet			Distance - 800 Feet			
	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	10-ft. logs	16-ft. logs	Average length logs	
10	$10.89	$6.91	$9.29	$25.40	$17.50	$22.20	$44.59	$31.52	$39.40	$11.25
12	7.81	5.52	6.82	19.19	14.78	17.29	34.63	26.97	31.37	8.60
14	6.21	4.59	5.43	16.08	12.73	14.42	29.29	23.95	26.70	6.67
16	5.19	3.98	4.53	14.03	11.52	12.61	25.82	22.05	23.50	5.58
18	4.49	3.56	3.98	12.46	10.65	11.37	22.99	20.33	21.42	4.92
20	3.92	3.23	3.56	11.28	9.86	10.38	21.12	18.82	19.97	4.46
22	3.56	2.93	3.23	10.38	9.26	9.86	19.82	17.74	18.79	4.10
24	3.32	2.78	3.02	9.86	8.84	9.47	18.79	17.01	18.01	3.83
26	3.11	2.62	2.84	9.56	8.57	9.14	18.10	16.35	17.29	3.62
28	2.96	2.50	2.68	9.26	8.33	8.84	17.71	15.93	16.86	3.47
30	2.81	2.41	2.56	8.99	8.11	8.54	17.32	15.57	16.44	3.32
32	2.68	2.32	2.47	8.72	7.93	8.27	16.92	15.32	16.08	3.17
34	2.56	2.23	2.38	8.48	7.75	8.02	16.56	15.08	15.72	3.05
36	2.47	2.14	2.29	8.27	7.57	7.81	16.20	14.84	15.35	2.93
38	2.38	2.08	2.20	8.05	7.42	7.63	15.84	14.63	14.99	2.84
40	2.29	2.05	2.11	7.90	7.27	7.45	15.57	14.42	14.63	2.75

Table 5.--Total loading cost per M bd. ft., gross log scale, by tree diameter and log length classes.

Tree DBH Class	Log Length in Feet				
	10	12	14	16	Average Length
14	$7.13	$6.40	$5.53	$4.67	$6.47
16	5.67	5.00	4.33	3.73	5.00
18	4.47	4.07	3.53	3.00	4.07
20	3.53	3.20	2.87	2.47	3.20
22	2.87	2.67	2.33	2.00	2.67
24	2.40	2.27	1.93	1.60	2.27
26	2.00	1.87	1.60	1.33	1.80
28	1.73	1.47	1.27	1.07	1.47
30	1.47	1.40	1.13	.93	1.27
32	1.33	1.27	1.07	.87	1.20
34	1.27	1.20	.93	.73	1.07
36	1.20	1.07	.93	.73	1.07
38	1.07	.93	.87	.67	.93
40	1.20	1.07	.93	.73	1.07
42	1.27	1.20	1.07	.87	1.20
44	1.47	1.40	1.27	1.07	1.40

Table 6.--Total loading cost per M bd. ft., gross log scale, by log diameter and length classes.

Log Diameter Class	Log Length in Feet				
	10	12	14	16	Average Length
10	$9.93	$8.33	$6.73	$5.13	$8.73
12	5.93	5.13	4.33	3.60	5.20
14	4.07	3.53	3.07	2.67	3.53
16	3.07	2.67	2.33	2.00	2.67
18	2.47	2.13	1.80	1.60	2.00
20	2.00	1.73	1.47	1.27	1.60
22	1.60	1.40	1.20	.93	1.27
24	1.40	1.13	.93	.80	1.07
26	1.20	.93	.87	.73	.93
28	1.07	.87	.73	.67	.87
30	1.07	.87	.73	.67	.87
32	1.07	.87	.73	.67	.87
34	1.07	.87	.73	.67	.87
36	1.07	.93	.87	.73	.93
38	1.20	1.07	.93	.87	1.07
40	1.27	1.20	1.07	.93	1.20

Table 7.--Total sawmilling cost per M bd. ft., lumber tally, by species group, tree diameter, and log length class

Tree DBH Class	Log Length in Feet									
	Hard Hardwoods					Soft Hardwoods				
	10	12	14	16	Average Length	10	12	14	16	Average Length
14	$18.31	$17.49	$16.68	$15.86	$17.49	$17.33	$16.02	$14.72	$13.73	$16.02
16	15.21	14.39	13.73	13.08	14.39	14.06	13.08	11.94	11.12	13.08
18	12.92	12.26	11.61	10.95	12.26	11.77	10.95	10.14	9.48	10.95
20	10.95	10.46	10.14	9.65	10.46	10.14	9.48	8.83	8.18	9.48
22	9.81	9.48	8.99	8.83	9.48	8.99	8.50	8.01	7.52	8.50
24	9.16	8.83	8.50	8.18	8.83	8.34	7.85	7.36	6.67	7.85
26	8.67	8.18	8.01	7.68	8.18	7.85	7.19	6.70	6.38	7.19
28	8.18	7.85	7.52	7.36	7.85	7.36	6.70	6.38	5.89	6.70
30	8.01	7.52	7.36	7.19	7.52	7.19	6.54	6.05	5.72	6.54
32	7.85	7.36	7.19	7.03	7.36	7.03	6.54	6.05	5.72	6.54
34	7.52	7.19	7.03	6.70	7.19	6.87	6.38	5.89	5.40	6.38
36	7.52	7.19	7.03	6.70	7.19	6.70	6.38	5.89	5.40	6.38
38	7.52	7.19	7.03	6.70	7.19	6.70	6.38	5.89	5.40	6.38
40	7.85	7.36	7.19	7.03	7.36	7.03	6.54	6.05	5.72	6.54
42	8.01	7.52	7.36	7.19	7.52	7.19	6.70	6.38	5.89	6.70
44	8.50	8.01	7.85	7.52	8.01	7.52	7.19	6.70	6.38	7.19

Table 8.--Total sawmilling cost per M bd. ft., lumber tally, by species group, log diameter, and log length class

Log Diameter Class	Log Length in Feet									
	Hard Hardwoods					Soft Hardwoods				
	10	12	12	16	Average Length	10	12	14	16	Average Length
10	$23.87	$21.26	$18.80	$16.13	$21.91	$23.87	$21.26	$18.80	$16.13	$21.91
12	15.21	14.06	13.24	12.43	14.39	14.06	13.24	12.43	11.61	13.24
14	11.94	11.44	10.79	10.14	11.44	11.12	10.46	9.97	9.32	10.46
16	10.30	9.65	9.32	8.83	9.65	9.48	8.83	8.17	7.52	8.83
18	9.32	8.83	8.50	8.01	8.83	8.17	7.85	7.19	6.54	7.52
20	8.50	8.17	8.01	7.52	8.17	7.52	7.19	6.54	5.89	7.03
22	7.85	7.52	7.52	7.19	7.52	7.03	6.54	6.05	5.40	6.38
24	7.52	7.36	7.19	7.03	7.36	6.54	6.05	5.72	5.23	5.89
26	7.36	7.19	7.03	6.70	7.19	6.38	5.89	5.40	5.07	5.72
28	7.36	7.36	7.36	7.19	7.36	6.38	6.05	5.72	5.23	5.89
30	7.52	7.52	7.52	7.52	7.52	6.54	6.38	5.89	5.40	6.05
32	7.85	7.85	7.85	8.01	7.85	6.70	6.54	6.38	5.89	6.54
34	8.50	8.50	8.67	8.83	8.50	7.03	6.70	6.70	6.54	6.70
36	8.99	9.48	9.65	9.97	9.48	7.36	7.19	7.19	7.19	7.19
38	9.65	10.14	10.46	10.95	10.30	7.85	7.85	7.85	8.01	7.85
40	10.46	11.12	11.94	11.94	11.44	8.50	8.67	8.83	8.99	8.67

Table 9.--Total sawmilling cost per M bd. ft., gross log scale, by species group, tree diameter, and log length class

Tree DBH Class	Log Length in Feet									
	Hard Hardwoods					Soft Hardwoods				
	10	12	14	16	Average Length	10	12	14	16	Average Length
14	$21.42	$20.46	$19.52	$18.56	$20.46	$21.23	$19.62	$18.03	$16.82	$19.62
16	16.96	16.04	15.31	14.58	16.04	16.31	15.17	13.85	12.90	15.17
18	13.95	13.24	12.54	11.83	13.24	13.18	12.26	11.36	10.62	12.26
20	11.50	10.98	10.65	10.13	10.98	11.05	10.33	9.62	8.92	10.33
22	10.10	9.76	9.26	9.09	9.76	9.53	9.01	8.49	7.97	9.01
24	9.30	8.96	8.63	8.30	8.96	8.67	8.16	7.65	7.02	8.16
26	8.71	8.22	8.05	7.72	8.22	8.05	7.37	6.87	6.54	7.37
28	8.14	7.81	7.48	7.32	7.81	7.43	6.77	6.44	5.95	6.77
30	7.93	7.44	7.29	7.12	7.44	7.19	6.54	6.05	5.72	6.54
32	7.73	7.25	7.08	6.92	7.25	6.99	6.51	6.02	5.69	6.51
34	7.45	7.05	6.89	6.57	7.05	6.77	6.28	5.80	5.32	6.28
36	7.33	7.01	6.85	6.53	7.01	6.57	6.25	5.77	5.29	6.25
38	7.33	7.01	6.85	6.53	7.01	6.50	6.19	5.71	5.24	6.19
40	7.61	7.14	6.97	6.82	7.14	6.78	6.31	5.84	5.52	6.31
42	7.73	7.26	7.10	6.94	7.26	6.90	6.43	6.12	5.65	6.43
44	8.20	7.73	7.58	7.26	7.73	7.18	6.87	6.40	6.09	6.87

Table 10.--Total sawmilling cost per M bd. ft., gross log scale, by species group, log diameter, and log length class

Log Diameter Class	Log Length in Feet									
	Hard Hardwoods					Soft Hardwoods				
	10	12	14	16	Average Length	10	12	14	16	Average Length
10	$29.48	$26.26	$23.22	$19.99	$27.06	$30.43	$27.11	$23.97	$20.64	$27.94
12	16.81	15.54	14.63	13.74	15.90	16.10	15.16	14.23	13.29	15.16
14	12.54	12.01	11.33	10.65	12.01	12.07	11.35	10.62	10.11	11.39
16	10.45	9.79	9.46	8.96	9.79	9.86	9.18	8.50	7.82	9.18
18	9.27	8.79	8.46	7.97	8.79	8.29	7.97	7.30	6.64	7.63
20	8.37	8.05	7.89	7.41	8.05	7.52	7.19	6.54	5.87	7.03
22	7.69	7.37	7.37	7.05	7.37	6.92	6.44	5.96	5.32	6.28
24	7.33	7.18	7.01	6.85	7.18	6.38	5.90	5.58	5.10	5.74
26	7.18	7.01	6.85	6.53	7.01	6.19	5.71	5.24	4.92	5.55
28	7.14	7.14	7.14	6.97	7.14	6.16	5.84	5 52	5.05	5.68
30	7.29	7.29	7.29	7.29	7.29	6.28	6.12	5 65	5.18	5.81
32	7.58	7.58	7.58	7.73	7.58	6.40	6.25	6.09	5.62	6.25
34	8.20	8.20	8.37	8.52	8.20	6.68	6.37	6.37	6.21	6.37
36	8.68	9.15	9.31	9.62	9.15	6.99	6.83	6.83	6.83	6.83
38	9.26	9.73	10.04	10.51	9.89	7.42	7.42	7.42	7.57	7.42
40	10.04	10.68	11.46	11.46	10.98	8.03	8.19	8.34	8.50	8.19

Table 11.--Summary of production costs per M bd. ft., gross log scale[1], for standardized tree-log relationships[2], skidding distance[3], skidding slope[4], and log length, by tree diameter class.

Tree DBH Class	16-ft. logs		10-ft. logs		Average length logs	
	Hard[5] Hardwoods	Soft[6] Hardwoods	Hard Hardwoods	Soft Hardwoods	Hard Hardwoods	Soft Hardwoods
14					$53.53	$52.69
16	$37.93	$36.25	$47.48	$46.83	45.48	44.61
18	33.46	32.25	41.28	40.51	40.21	39.23
20	30.29	29.08	36.25	34.28	35.74	35.09
22	27.98	26.86	32.99	32.42	32.88	32.13
24	26.17	25.61	30.78	30.15	30.78	29.98
26	24.88	23.70	29.11	28.45	28.84	27.99
28	23.88	22.51	27.69	26.98	27.54	26.50
30	23.30	21.90	26.79	26.05	26.56	25.66
32	22.84	21.61	26.07	25.33	26.03	25.29
34	22.20	20.95	25.47	24.79	25.56	24.79
36	22.05	20.81	25.08	24.32	25.49	24.73
38	21.92	20.63	24.78	23.95	25.37	24.55
40	22.22	20.92	25.06	24.23	25.72	24.89
42	22.42	21.13	25.14	24.31	26.13	25.30
44	22.90	21.73	25.74	24.73	27.11	26.25

[1] Stumpage cost and allowance for profit or risk are not included.

[2] For 16-ft. and 10-ft. logs, the assumption is that each tree contains two logs of equal length. Average trees, however, contain a variable number of logs per tree and have variable log length.

[3] Skidding distance for 16-ft. and 10-ft. logs is standardized at 100 feet. For average logs and trees, the distance is 167 feet.

[4] Skidding slope for 16-ft. and 10-ft. logs is standardized at zero percent. For average logs and trees, the slope is 30 percent.

[5] Includes ash, black birch, beech, hickory, sugar maple, and all oaks.

[6] Includes basswood, buckeye, black cherry, cucumber, chestnut, black gum, red maple, and yellow-poplar.

Table 12.--Summary of production cost per M bd. ft., gross log scale[1/], for standardized skidding distance[2/], skidding slope[3/], and log length[4/], by log diameter class.

Log Diameter Class	16-Ft. Logs		10-Ft. Logs		Average Length	
	Hard[5/] Hardwoods	Soft[6/] Hardwoods	Hard Hardwoods	Soft Hardwoods	Hard Hardwoods	Soft Hardwoods
10	$45.53	$46.18	$66.44	$67.39	$64.11	$64.99
12	36.04	35.59	46.07	45.36	45.77	45.03
14	30.93	30.39	37.85	37.38	37.48	36.82
16	27.71	26.57	33.25	32.66	32.74	32.13
18	25.72	24.39	30.46	29.48	30.03	28.87
20	24.35	22.83	28.36	27.51	28.15	27.13
22	23.26	21.53	26.68	25.91	26.58	25.49
24	22.65	20.90	25.68	24.73	25.77	24.33
26	22.08	20.47	24.97	23.98	25.16	23.70
28	22.33	20.41	24.52	23.54	25.01	23.55
30	22.52	20.41	24.45	23.44	24.96	23.48
32	22.84	20.73	24.54	23.36	25.07	23.74
34	23.53	21.22	24.99	23.47	25.53	23.70
36	24.59	21.80	25.32	23.63	26.39	24.07
38	25.55	22.61	25.91	24.07	27.17	24.70
40	26.48	23.52	26.69	24.68	28.29	25.50

[1/] Stumpage cost and allowance for profit or risk are not included.

[2/] Skidding distance for 16-ft. and 10-ft. logs is standardized at 100 feet. For average logs, the distance is 167 feet.

[3/] Skidding slope for 16-ft. and 10-ft. logs is standardized at zero percent. For average logs, the slope is 30 percent.

[4/] Average log length varies from 11.3 feet at a diameter of 8 inches to 12.8 feet at 20 inches and remains constant thereafter.

[5/] Includes ash, black birch, beech, hickory, sugar maple, and all oaks.

[6/] Includes basswood, buckeye, black cherry, cucumber, chestnut, black gum, red maple, and yellow-poplar.

Costs and Returns Under Specified Conditions

The choice of standardized conditions under which production costs can be totaled and compared with lumber value yields is very large. But in this technical note, the limitations of space prescribe that only a few detailed comparisons of costs and returns can be made.

In table 13, costs and returns are compared by tree diameter classes for the average conditions observed at Bent Creek -- average-length logs, average number of logs per tree, skidding distance of 167 feet, and skidding slope of 30 percent. Table 14 is similarly adapted to average conditions, but presents data by log diameter classes. Tables 15 and 16 compare costs and returns under the assumption that skidding distance is 100 feet and slope is zero. Each tree is presumed to consist of two logs and each log is 16 feet long. Tables 17 and 18 compare costs and returns for the same conditions as in tables 15 and 16, except that log length is standardized at 10 feet.

Tables 13 to 18 show the margins which are available, under specified conditions, for stumpage and profit or risk. To a large degree, the margins follow the conventional pattern of increasing as diameters increase. There are a number of exceptions, however, where the differences in margins for a particular species and log grade follow no definite pattern of increase or decrease or where the trend is opposite -- i.e., margins increase as diameters diminish. The latter trends can be noted more particularly for log diameter classes than for tree diameter classes and are most evident in yellow-poplar, cucumber, and sugar maple.

The fact that the margins for some species and log grades follow a trend contrary to the generally accepted pattern is a consequence of expressing results on a Scribner Decimal C log rule basis. On a mill tally basis, costs diminish and value yields increase as diameters increase, with the result that the larger diameters show greater margins between costs and returns. But, in converting to a log scale basis, the effect of overrun and underrun in the present study was to cause value yields to diminish sufficiently as diameters increased to produce larger margins at smaller diameters for some species and grades.

By adding stumpage costs to the costs of production, it is possible to point out the marginal sizes of trees and logs, i.e., the sizes at which total costs equal value yields. The presentation of data in this note has been such as to permit the calculation of marginal sizes under any stumpage prices that may be set, but for the purposes of illustration,

prices established for the Bent Creek and Big Ivy operations[4/] have been used in the determination of marginal log and tree sizes. (See tables 19 and 20.)

Under the conditions specified in tables 19 and 20, the marginal diameters represent the sizes below which operations can be conducted only at a loss. For many species and grades there is a net yield at all sizes. Only one species, black birch -- and only for 10-foot and average length logs--, does not indicate a net yield at any size. Theoretically, there is an upper marginal size as well as a lower margin beyond which operations are unprofitable. Actually, for the diameter range observed, chestnut was the only species which had an upper marginal size -- 37 inches for 16-foot logs, 32 inches for 10-foot and average-length logs, and 41 inches for average trees.

[4/] Following are the sale prices per M bd. ft., log scale, for Bent Creek and Big Ivy stumpage: ash, $9; basswood, $12; beech, $4; black birch, $8.50; buckeye, $6.50; black cherry, $12.00; chestnut, $5; black gum, $2; hickory, $2; cucumber magnolia, $12; red maple, $7; sugar maple, $15.50; black oak, $5; chestnut oak, $4; northern red oak, $12; scarlet oak, $2; white oak, $9; and yellow-poplar, $18.

Table 13.--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming average tree-log relationships, skidding distance, and slope[2].

Tree DBH Class	Ash	Basswood			Beech	Black Birch		Buckeye		Black Cherry	Chestnut
	All Log Grades	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 2 Logs	All Log Grades
14	$ 5.67			$ 6.97	$ -4.42		$ -10.81				$ -12.44
16	10.97		$23.45	11.72	1.59	$19.58	- 5.32		$ -2.38	$ 3.04	- 6.32
18	14.83	$40.83	25.98	15.17	5.42	22.44	- 2.25	$10.87	1.85	7.94	- 2.73
20	17.86	43.53	28.00	17.89	9.36	25.07	0.63	14.60	5.11	11.60	- 0.33
22	19.91	45.81	29.21	20.57	11.98	26.30	2.07	17.35	7.05	14.11	1.61
24	20.98	47.03	29.96	21.32	13.59	27.18	3.21	19.90	8.73	15.61	3.13
26	22.19	48.12	30.85	21.58	15.06	28.32	4.42	21.35	10.15	17.40	4.39
28	22 81	48.74	31.30	22.14	16.33	29.33	4.73	22.54	11.10	18.69	5.51
30	23.46	48.95	32.00	21.85	16.46			23.24	11.42	18.92	5.97
32	23.47	48.72	31.66	21.19				23.33	11.29	19.29	5.80
34											5.88
36											5.76
38											5.55
40											5.25
42											4.89

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log lengths, average number of logs per tree, a skidding distance of 167 feet, and skidding slope of 30 percent.

Table 13 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming average tree-log relationships, skidding distance, and slope[2].

Tree DBH Class	Cucumber			Black Gum			Hickory		Red Maple		
	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
14			$2.09			$ -13.55		$ -6.15			$ -5.44
16		$23.10	6.74		$ -1.82	- 6.44	$ 3.80	0.28		$10.22	0.46
18	$38.11	24.77	9.19	$ 6.79	2.07	- 1.68	7.51	4.53	$34.61	14.33	4.74
20	37.98	25.99	11.02	10.35	5.56	2.02	10.76	7.89	38.59	17.69	8.35
22	39.12	26.21	12.11	12.73	7.94	4.40	12.86	9.86	40.45	20.17	10.61
24	40.81	26.34	12.33	14.61	9.57	6.10	14.12	11.23	42.77	22.37	12.42
26	42.26	26.23	13.36	16.49	11.06	7.76	15.28	12.49	44.25	23.94	14.24
28	43.15	26.30	13.55	17.81	11.93	8.44	16.07	13.56	45.25	25.49	15.50
30	41.98	25.56	13.74	18.62	12.42	9.02	16.50	14.10	45.62	26.13	16.33
32							16.50	14.17	45.89	26.59	16.80
34									46.18	26.82	17.62
36									46.02	26.75	17.65

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log lengths, average number of logs per tree, a skidding distance of 167 feet, and skidding slope of 30 percent.

Table 13 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming average tree-log relationships, skidding distance, and slope[2].

Tree DBH Class	Sugar Maple			Black Oak			Chestnut Oak				N. Red Oak	
	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs
14			$ 5.95			$ -12.34				$ -11.21		
16		$25.28	10.72		$ -2.05	- 6.91			$ 2.26	- 5.09		
18	$70.34	30.09	15.81	$13.04	1.77	- 2.26		$12.52	5.43	- 1.50		$35.76
20	70.77	35.40	20.45	15.54	5.06	1.15	$25.23	16.25	8.78	2.37	$45.10	38.66
22	69.08	40.11	21.59	18.89	7.81	3.80	27.11	18.98	10.79	4.83	46.32	40.59
24	69.75	40.91	22.21	22.19	9.77	4.93	29.25	20.22	13.02	6.17	46.87	41.33
26	70.49	41.64	23.58	24.23	11.37	7.31	30.75	22.93	14.64	7.51	48.56	42.40
28	70.66	42.87	24.19	25.57	12.96	8.25	31.76	24.65	15.59	8.23	49.30	43.24
30	70.52	43.08	25.18	27.05	13.62	9.59	33.18	24.80	16.42	9.15	49.96	43.67
32	70.01			27.87	13.72	9.77	33.61	25.05	16.81	9.13	49.97	43.80
34				28.22			34.81	26.22			50.10	43.49
36				28.44			35.51	26.17			50.06	43.75
38											49.99	43.52
40											49.16	42.44
42											48.29	41.89
44											46.78	

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log lengths, average number of logs per tree, a skidding distance of 167 feet, and skidding slope of 30 percent.

Table 13 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming average tree-log relationships, skidding distance, and slope[2]

Tree DBH Class	N. Red Oak (Cont.)		Scarlet Oak		White Oak			Yellow-poplar			
	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
14		$ -.28		$ -11.58			$ -7.85				$12.96
16	$ 9.29	5.69	$ 0.69	- 6.31		$14.58	-3.36			$27.89	15.99
18	13.20	9.64	5.35	- 2.54	$29.35	17.48	0.86		$48.97	29.47	18.00
20	16.97	13.71	10.75	.89	32.00	20.76	5.04	$54.29	48.70	30.84	19.71
22	19.58	14.70	12.29	2.99	33.89	21.50	7.89	54.52	48.59	31.02	21.01
24	21.40	16.43	14.50	4.47	37.66	22.57	8.97	53.66	47.94	31.50	21.64
26	23.43	18.25	16.39	5.87	40.36	24.01	10.03	53.30	48.18	31.83	22.94
28	25.15	18.87	17.41	6.65	41.32	24.72	10.44	51.40	48.43	32.27	23.38
30	26.44	19.46	18.54		42.51	25.50	10.82	52.69	48.31	32.76	23.23
32	26.89	19.97	19.22		42.91	26.19	10.90	51.59	47.54	32.41	23.25
34	27.46	20.12			43.32	26.17	11.09	50.51	47.62	33.11	22.83
36	27.64				43.95			50.29	46.58	32.76	22.81
38	27.88							49.72	45.91	32.05	
40								48.64	45.10	31.48	
42								47.74			
44								45.96			

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log length, average number of logs per tree, a skidding distance of 167 feet, and skidding slope of 30 percent.

Table 14.--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming average log lengths, skidding distance, and slope[2].

Log Diameter Class	Ash	Basswood			Beech	Black Birch		Buckeye		Black Cherry	Chestnut
	All Log Grades	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 2 Logs	All Log Grades
10	$ 0.97			$ -2.11	$ -12.62		$ -15.88				$ -24.69
12	12.74		$27.14	10.45	1.02	$22.52	- 6.08		$ -1.29	$ 3.13	- 7.92
14	17.66	$44.77	29.22	16.29	7.82	23.65	- 0.78	$12.61	4.48	9.65	- 1.90
16	19.49	46.18	28.58	19.09	10.67	25.53	1.65	17.45	7.45	13.25	1.67
18	20.22	46.42	28.15	20.74	12.61	26.57	2.54	20.20	9.23	15.48	3.83
20	20.76	44.85	27.14	21.07	13.86	26.82	3.13	22.17	10.09	16.23	4.88
22	21.72	44.19	27.43	22.05	14.98	27.87	4.46	23.63	10.87	17.11	5.83
24	21.70	44.53	28.27	22.56	15.22	28.42	4.89	24.56	11.73	17.92	6.68
26	22.06	43.94	28.60	22.39	15.76			24.91	11.79	17.66	6.69
28	22.53	43.01	28.46	21.98				24.64	11.65	17.33	6.39
30											5.72
32											4.88
34											4.51
36											3.47
38											2.21

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log lengths, a skidding distance of 167 feet, and skidding slope of 30 percent.

Table 14 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming average log lengths, skidding distance, and slope[2]

Log Diameter Class	Cucumber			Black Gum			Hickory		Red Maple		
	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
10			$ -6.31			$ -25.18		$ -13.10			$ -16.71
12		$29.55	6.95		$ -1.11	- 7.34	$ 4.67	0.63		$ 9.93	0.46
14	$44.69	28.08	10.52	$ 9.82	4.57	0.26	10.52	6.78	$31.98	16.93	6.83
16	41.43	25.88	11.89	13.16	8.12	4.42	13.32	9.85	36.05	20.25	10.45
18	40.74	24.93	12.49	15.64	10.23	6.66	14.05	11.49	39.78	22.37	12.62
20	39.55	23.72	12.22	16.59	11.00	7.77	15.03	12.28	42.90	23.16	13.87
22	38.07	23.20	12.70	17.43	11.89	8.94	15.75	13.10	43.16	24.40	14.45
24	36.79	22.84	12.92	18.03	12.79	9.63	16.00	13.48	43.58	25.38	15.41
26	35.73	22.41	12.97	18.33	12.89	9.68	15.80	13.41	43.33	25.86	15.88
28							15.19	12.95	43.43	26.15	15.90
30									43.52	26.23	16.04
32									43.20	26.70	15.69

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log lengths, a skidding distance of 187 feet, and skidding slope of 30 percent.

Table 14 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming average log lengths, skidding distance, and slope[2]

Log Diameter Class	Sugar Maple			Black Oak			Chestnut Oak				N. Red Oak	
	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs
10			$ -0.92			$ -20.00				$ -20.79		
12		$26.34	11.77		$ -0.76	- 5.84			$ 2.79	- 4.63		
14	$80.66	32.57	17.81	$12.52	4.67	- 0.91		$16.41	8.12	2.02		$41.30
16	72.10	35.86	20.30	18.12	8.17	2.93	$26.84	19.25	11.28	5.83	$47.26	41.28
18	68.93	37.70	21.90	22.71	9.54	5.26	28.67	20.71	13.26	8.44	46.84	41.67
20	66.38	38.23	22.35	25.26	10.56	6.56	30.05	21.35	14.90	10.09	47.93	42.24
22	64.86	38.61	22.76	26.95	11.92	7.51	31.96	22.60	16.40	11.92	48.73	42.88
24	63.29	39.11	22.81	27.28	12.54	7.80	32.86	23.20	16.97	12.33	49.37	43.50
26	62.27	39.26	23.23	27.61	13.13	8.67	33.77	23.20	17.46	12.55	49.45	43.71
28	61.93	40.24	23.20	27.71	13.20	9.03	34.18	24.55	17.70	12.92	49.77	44.09
30				27.73			35.05	24.71			50.77	44.78
32				27.71							50.91	44.85
34											50.12	44.35
36											49.53	43.62
38											48.76	42.82
40											46.90	

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log lengths, a skidding distance of 167 feet, and skidding slope of 30 percent.

Table 14 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, for species, log grade, and log diameter class, assuming average log lengths, skidding distance, and slope[2]

Log Diameter Class	N. Red Oak (Cont.)		Scarlet Oak		White Oak			Yellow-poplar			
	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
10		$ -9.22		$ -18.70			$ -17.16				$ 6.12
12	$ 9.66	5.69	$ 0.36	- 5.84		$15.42	- 4.07			$34.33	17.01
14	14.92	11.15	7.53	0.54	$33.29	17.59	1.93		$57.59	31.19	18.01
16	19.36	14.27	14.30	3.14	34.74	19.71	5.72	$55.38	51.66	30.29	19.04
18	21.45	15.75	14.75	4.62	36.39	21.75	7.39	52.07	49.05	30.23	20.05
20	23.56	16.89	16.50	5.65	39.08	23.44	8.86	49.88	46.13	29.35	20.03
22	25.47	17.66	17.64	7.17	41.24	25.32	10.18	48.55	45.63	29.36	20.35
24	26.37	18.42	18.06	7.72	42.84	25.20	10.74	47.12	44.70	29.10	20.79
26	27.43	18.72	18.57		43.75	25.98	11.03	46.35	44.43	29.17	20.61
28	28.29	19.13	18.69		43.98	26.63	10.57	45.96	43.27	29.14	20.52
30	28.46	19.49			45.27	27.26	10.42	45.94	42.70	28.59	20.80
32	28.44							45.02	42.75	28.68	20.72
34	28.41							46.33	42.17	28.44	
36								45.76	41.46	27.80	
38								44.72			
40								43.98			

[1] Production costs do not include stumpage or profit and risk.

[2] "Average conditions" refers to average log lengths, a skidding distance of 167 feet, and skidding slope of 30 percent.

Table 15.--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming each tree produces two 16-foot logs, skidding distance is 100 feet, and slope zero.

Tree DBH Class	Ash	Basswood			Beech	Black Birch		Buckeye		Black Cherry	Chestnut
	All Log Grades	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 2 Logs	All Log Grades
16	$18.52		$31.81	$20.08	$ 9.24	$27.13	$ 2.23		$ 5.98	$11.40	$ 2.04
18	21.58	$47.81	32.96	22.15	12.17	29.19	4.50	$17.85	8.83	14.92	4.25
20	23.31	49.54	34.01	23.90	14.81	30.52	6.16	20.61	11.12	17.61	5.68
22	24.81	51.08	34.48	25.84	16.88	31.20	6.97	22.62	12.32	19.38	6.88
24	25.59	51.40	34.33	25.69	18.20	31.79	7.82	24.27	13.10	19.98	7.50
26	26.15	52.41	35.14	25.87	19.02	32.28	8.38	25.64	14.44	21.69	8.68
28	26.47	52.73	35.29	26.13	19.99	32.99	8.39	26.53	15.09	22.69	9.50
30	26.72	52.71	35.76	25.61	19.72			27.00	15.18	22.68	9.73
32	26.66	52.40	35.34	24.88				27.01	14.97	22.97	9.48
34											9.72
36											9.68
38											9.47
40											9.22
42											9.06

Tree DBH Class	Cucumber			Black Gum			Hickory		Red Maple		
	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
16		$31.46	$15.10		$ 6.54	$ 1.92	$11.35	$ 7.83		$18.48	$ 8.82
18	$45.09	31.85	16.17	$13.77	9.05	5.30	14.26	11.28	$41.59	21.41	11.72
20	43.99	32.00	17.03	16.36	11.57	8.03	16.21	13.34	44.60	23.70	14.36
22	44.39	31.46	17.38	18.00	13.21	9.69	17.74	14.76	45.72	25.44	15.88
24	45.18	30.71	16.70	18.98	13.94	10.47	18.73	15.84	47.14	26.74	16.79
26	46.55	30.52	17.65	20.78	15.35	12.05	19.24	16.45	48.54	28.23	18.53
28	47.14	30.19	17.54	21.80	15.92	12.43	19.73	17.22	49.24	29.48	19.49
30	45.74	29.32	17.50	22.38	16.18	12.78	19.76	17.36	49.38	29.89	20.09
32							19.69	17.36	49.57	30.27	20.48
34									50.02	30.66	21.46
36									49.94	30.67	21.57

[1/] Production costs do not include stumpage or profit and risk.

Table 15 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming each tree produces two 16-foot logs, skidding distance is 100 feet, and slope zero.

Tree DBH Class	Sugar Maple			Black Oak			Chestnut Oak				N. Red Oak	
	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs
16		$32.83	$18.27		$ 5.05	$ 0.64			$ 9.81	$ 2.46		
18	$77.09	37.27	22.56	$19.79	8.52	4.49		$19.27	12.18	5.35		$47.51
20	76.22	40.85	25.90	20.99	10.51	6.60	$30.68	21.70	14.23	7.82	$50.55	44.11
22	73.98	45.01	26.43	23.79	12.71	8.70	32.02	23.88	15.69	9.73	51.22	45.49
24	74.36	45.52	26.83	26.80	14.38	9.54	33.81	24.83	16.91	10.78	51.48	45.94
26	74.49	45.60	27.54	28.19	15.33	11.27	34.71	26.89	18.60	11.47	52.32	46.36
28	74.33	46.53	27.85	29.23	16.62	11.91	35.42	28.31	19.25	11.89	52.91	46.90
30	73.78	46.34	28.44	30.31	16.86	12.85	36.44	28.06	19.68	12.41	53.22	46.93
32	73.20			31.06	16.91	12.96	36.80	28.24	20.00	12.32	53.16	46.99
34				31.58			38.17	29.58			53.46	46.85
36				31.88			38.95	29.61			53.50	47.19
38											53.44	46.97
40											52.66	45.94
42											52.00	45.60
44											50.99	

[1/] Production costs do not include stumpage or profit and risk.

Table 15 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming each tree produces two 16-foot logs, skidding distance is 100 feet, and slope zero.

Tree DBH Class	N. Red Oak (Cont.)		Scarlet Oak		White Oak			Yellow-poplar			
	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
16	$16.84	$13.24	$ 8.24	$ 1.24		$22.13	$ 4.19			$36.25	$24.35
18	19.95	16.39	12.10	4.21	$36.10	24.23	7.61		$55.95	36.45	24.98
20	22.42	19.16	16.20	6.34	37.45	25.94	10.49	$60.30	54.71	36.85	25.74
22	24.48	19.60	17.19	7.89	38.79	26.40	12.79	59.79	53.86	36.29	26.28
24	26.01	21.04	19.11	9.08	42.27	27.18	13.58	58.03	52.31	35.87	26.01
26	27.39	22.21	20.55	9.83	44.32	27.97	13.99	57.59	52.47	36.12	27.23
28	28.81	22.53	21.07	10.31	44.98	28.38	14.10	57.39	52.42	36.26	27.37
30	29.70	22.72	21.80		45.77	28.76	14.08	56.45	52.07	36.52	26.99
32	30.04	23.16	22.41		46.10	29.38	14.09	55.27	51.22	36.09	26.93
34	30.82	23.48			46.68	29.53	14.45	54.35	51.46	36.95	26.67
36	31.08				47.39			54.21	50.50	36.68	26.73
38	31.33							53.64	49.83	35.97	
40								52.61	49.07	35.45	
42								51.91			
44								50.48			

[1/] Production costs do not include stumpage or profit and risk.

Table 16.--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 16 feet long, skidding distance is 100 feet, and slope zero.

Log Diameter Class	Ash	Basswood			Beech	Black Birch		Buckeye		Black Cherry	Chestnut
	All Log Grades	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 2 Logs	All Log Grades
10	$19.55			$16.70	$ 5.96		$ 2.70				$ -5.88
12	22.47		$36.58	19.89	10.75	$32.25	3.65		$ 8.15	$12.57	1.52
14	24.21	$51.20	35.65	22.72	14.37	30.20	5.77	$19.04	10.91	16.08	4.53
16	24.52	51.74	34.14	24.65	15.70	30.56	6.68	23.01	13.01	18.81	7.23
18	24.53	50.90	32.63	25.22	16.92	30.88	6.85	24.68	13.71	19.96	8.31
20	24.56	49.15	31.44	25.37	17.66	30.62	6.93	26.47	14.39	20.53	9.18
22	25.04	48.15	31.39	26.01	18.30	31.19	7.78	27.59	14.83	21.07	9.79
24	24.82	47.96	31.70	25.99	18.34	31.54	8.01	27.99	15.16	21.35	10.11
26	25.14	47.17	31.83	25.62	18.84			28.14	15.02	20.89	9.92
28	25.21	46.15	31.60	25.12				27.78	14.79	20.47	9.53
30											8.79
32											7.89
34											6.99
36											5.74
38											4.30

[1/] Production costs do not include stumpage or profit and risk.

Table 16 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 16 feet long, skidding distance is 100 feet, and slope zero.

Log Diameter Class	Cucumber			Black Gum			Hickory		Red Maple		
	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
10			$12.50			$ -6.37		$ 5.48			$ 2.10
12		$38.99	16.39		$ 8.33	2.10	$14.40	10.36		$19.37	9.90
14	$51.12	34.51	16.95	$16.25	11.00	6.69	17.07	13.34	$38.41	23.36	13.32
16	46.99	31.44	17.45	18.72	13.68	9.98	18.35	14.88	41.65	25.81	16.01
18	45.22	29.41	16.97	20.12	14.71	11.14	18.36	15.80	44.26	26.83	17.10
20	43.85	28.02	16.52	20.89	15.30	12.09	18.83	16.05	46.10	27.46	17.57
22	42.03	27.16	16.66	21.39	15.85	12.90	19.07	16.42	47.12	28.36	18.39
24	40.22	26.27	16.35	21.46	16.22	13.06	19.12	16.52	47.01	28.81	18.84
26	38.96	25.64	16.20	21.56	16.12	12.91	18.88	16.49	46.56	29.09	19.11
28							17.87	15.63	46.63	29.29	19.04
30									46.59	29.30	19.11
32									46.21	29.71	18.70

[1/] Production costs do not include stumpage or profit and risk.

Table 16 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 16 feet long, skidding distance is 100 feet, and slope zero.

Log Diameter Class	Sugar Maple			Black Oak			Chestnut Oak				N. Red Oak	
	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs
10			$17.66			$ -1.42				$ -2.21		
12		$36.07	21.50		$ 8.97	3.89			$12.52	5.10		
14	$87.21	39.12	24.36	$19.07	11.22	5.64		$22.96	14.67	8.57		$47.85
16	77.13	40.89	25.33	23.15	13.20	7.96	$31.87	24.28	16.31	10.86	$52.29	46.31
18	73.24	42.01	26.21	27.02	13.85	9.57	32.98	25.02	17.57	12.79	51.15	45.98
20	70.18	42.03	26.15	29.06	14.36	10.36	33.85	25.15	18.70	13.89	51.73	46.04
22	68.18	40.93	26.08	30.27	15.24	10.83	35.28	25.92	19.72	15.24	52.05	46.20
24	66.41	42.23	25.93	30.40	15.66	10.92	35.98	26.32	20.09	15.45	52.49	46.62
26	65.35	42.34	26.30	30.69	16.23	11.75	36.85	26.28	20.54	15.63	52.53	46.79
28	64.61	42.92	25.88	30.39	15.88	11.71	36.86	27.23	20.38	15.60	52.45	46.77
30				30.17			37.49	27.15			53.21	47.22
32				29.94							53.14	47.08
34											52.12	46.35
36											51.33	45.42
38											50.38	44.44
40											48.71	

[1/] Production costs do not include stumpage or profit and risk.

Table 16 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 16 feet long, skidding distance is 100 feet, and slope zero.

Log Diameter Class	N. Red Oak (Cont.)		Scarlet Oak		White Oak			Yellow-poplar			
	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
10		$ 9.36		$-0.12			$ 5.42				$24.93
12	$19.39	15.42	$10.09	3.89		$25.15	5.66			$43.77	26.45
14	21.47	17.70	14.10	7.09	$39.84	24.14	8.48		$64.02	37.62	24.44
16	24.41	19.30	19.33	8.17	39.77	24.74	10.35	$60.94	57.22	35.85	24.60
18	25.76	20.06	19.06	8.93	40.70	26.06	11.60	56.55	53.53	34.71	24.53
20	27.36	20.69	20.30	9.45	42.88	27.24	12.66	54.18	50.43	33.65	24.33
22	28.79	20.98	20.96	10.49	44.56	28.64	13.50	52.51	49.59	33.32	24.29
24	29.49	21.61	21.18	10.84	45.96	28.32	13.86	50.55	48.13	32.53	24.22
26	30.51	21.80	21.65		46.83	29.06	14.11	49.58	47.66	32.40	24.04
28	30.97	21.81	21.37		46.66	29.31	13.25	49.10	46.41	32.28	24.06
30	30.90	21.93			47.71	29.70	12.86	49.01	45.77	31.76	23.87
32	30.67							48.03	45.76	31.69	23.73
34	30.41							48.81	44.65	30.92	
36								48.03	43.73	30.07	
38								46.81			
40								45.96			

[1/] Production costs do not include stumpage or profit and risk.

Table 17.--Margins between production costs[1] and lumber value yielded per M bd. ft. gross log scale, by species, log grade, and tree diameter class, assuming each tree produces two 16-foot logs, skidding distance is 100 feet, and slope zero.

Tree DBH Class	Ash	Basswood			Beech	Black Birch		Buckeye		Black Cherry	Chestnut
	All Log Grades	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 2 Logs	All Log Grades
16	$ 8.97		$21.23	$ 0.24	$ -0.41	$17.58	$ -7.32		$ -4.60	$ 0.82	$ -8.64
18	13.76	$39.55	24.70	5.12	4.35	21.37	-3.32	$ 9.59	0.57	6.46	4.01
20	17.35	44.34	28.81	10.82	8.85	24.56	0.12	15.41	5.92	12.41	0.69
22	19.80	45.52	28.12	12.64	11.87	26.19	1.96	17.96	6.76	13.82	1.32
24	20.98	46.86	29.79	14.22	13.59	27.18	3.21	19.73	8.51	15.44	3.96
26	21.92	47.14	30.39	15.45	14.79	28.05	4.15	20.89	9.69	16.94	3.93
28	22.66	48.26	30.82	16.98	16.18	29.18	4.58	22.06	10.62	18.21	5.03
30	23.23	48.56	31.61	16.97	16.23			22.85	11.03	18.53	5.50
32	23.33	48.58	31.52					23.19	11.15	19.15	5.64
34											5.88
36											6.24
38											6.13
40											5.91
42											5.88

[1] Production costs do not include stumpage or profit and risk.

Table 17 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming each tree produces two 10-foot logs, skidding distance is 100 feet, and slope zero.

Tree DBH Class	Cucumber			Black Gum			Hickory		Red Maple		
	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
16		$20.88	$ 4.52		$ -4.04	$ -8.66	$ 1.80	$ -0.72		$ 8.00	$ -1.76
18	$36.83	23.59	7.91	$ 5.51	0.79	-2.96	6.44	3.46	$33.33	13.05	3.46
20	38.79	26.80	11.83	11.16	6.37	2.83	10.25	7.38	39.40	18.50	9.16
22	38.83	25.92	11.82	12.44	7.65	4.11	12.75	9.75	40.16	19.88	10.32
24	40.64	26.17	12.16	14.44	9.40	5.93	14.12	11.23	42.60	22.20	12.25
26	41.80	25.77	12.90	16.03	10.60	7.30	15.01	12.22	43.79	23.48	13.78
28	42.67	25.82	13.07	17.33	11.45	7.96	15.92	13.41	44.77	25.01	15.02
30	41.59	25.17	13.35	18.23	12.03	8.63	16.27	13.87	45.23	25.74	15.94
32							16.36	14.03	45.75	26.45	16.66
34									46.18	26.82	17.62
36									46.50	27.23	18.13

[1] Production costs do not include stumpage or profit and risk.

Table 17 (Continued) -- Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming each tree produces two 10-foot logs, skidding distance is 100 feet, and slope zero.

Tree DBH Class	Sugar Maple			Black Oak			Chestnut Oak				N. Red Oak	
	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs
16		$23.28	$ 8.72		$ -4.05	$ -8.91			$ 0.26	$ -7.09		
18	$69.27	29.02	14.74	$11.97	0.70	-3.33		$11.45	4.36	-2.47		$34.69
20	70.26	34.89	19.94	15.03	4.55	0.64	$24.72	15.14	8.27	1.86	$44.59	38.19
22	68.97	40.00	21.48	18.78	7.70	3.69	27.00	18.87	10.70	4.72	46.52	40.48
24	69.75	40.91	22.21	22.19	9.77	4.93	29.25	20.22	13.02	6.17	46.87	41.31
26	70.22	41.37	23.31	23.96	11.10	7.04	30.48	22.66	14.37	7.24	48.29	42.13
28	70.51	42.72	24.04	25.42	12.81	8.10	31.61	24.50	15.44	8.08	49.15	43.04
30	70.29	42.85	24.95	26.82	13.39	9.36	32.85	24.58	16.19	8.92	49.77	43.44
32	69.87			27.73	13.58	9.63	33.47	24.91	16.67	8.99	49.83	43.66
34				28.31			34.90	26.31			50.19	43.58
36				28.85			35.92	26.58			50.47	44.16
38											50.58	44.11
40											49.82	43.10
42											49.28	42.88
44											48.15	

[1/] Production costs do not include stumpage or profit and risk.

Table 17 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and tree diameter class, assuming each tree produces two 10-foot logs, skidding distance is 100 feet, and slope zero.

Tree DBH Class	N. Red Oak (Cont.)		Scarlet Oak		White Oak			Yellow-poplar			
	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
16	$ 7.29	$ 3.69	$ -1.31	$ -8.31		$12.58	$ -5.36			$25.67	$13.77
18	12.13	8.57	4.28	-3.61	$28.28	16.41	-0.21		$47.69	28.19	16.72
20	16.46	13.20	10.24	0.38	31.49	19.98	4.53	$55.10	49.51	31.65	20.54
22	19.47	14.59	12.18	2.88	33.78	21.39	7.78	54.23	48.30	30.73	20.72
24	21.40	16.43	14.50	4.47	37.66	22.57	8.97	53.49	47.77	31.33	21.47
26	23.16	17.98	16.32	5.60	40.09	23.74	9.76	52.84	47.72	31.37	22.48
28	25.00	18.72	17.26	6.50	41.17	24.57	10.29	52.92	47.95	31.79	22.90
30	26.21	19.23	18.31		42.28	25.27	10.59	52.30	47.92	32.37	22.84
32	26.71	19.83	19.08		42.77	26.05	10.76	51.45	47.40	32.27	23.11
34	27.55	20.21			43.41	26.26	11.18	50.51	47.62	33.11	22.83
36	28.05				44.36			50.77	47.06	33.24	23.22
38	28.47							50.32	46.51	32.65	
40								49.30	45.76	32.14	
42								48.73			
44								47.48			

[1/] Production costs do not include stumpage or profit and risk.

Table 18 --Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 10 feet long, skidding distance is 100 feet, and slope zero

Log Diameter Class	Ash	Basswood			Beech	Black Birch		Buckeye		Black Cherry	Chestnut
	All Log Grades	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 2 Logs	All Log Grades
10	$ -1.36			$ -4.51	$-14.95		$ -18.21				$-27.09
12	12.44		$26.81	10.12	0.72	$22.22	- 6.38		$ -1.62	$ 2.80	- 8.25
14	17.29	$44.21	28.66	15.73	7.45	23.28	- 1.15	$12.05	3.92	9.09	- 2.46
16	18.98	45.65	28.05	18.56	10.16	25.02	1.14	16.92	6.92	12.72	1.14
18	19.79	45.81	27.54	20.13	12.18	26.14	2.11	19.59	8.62	14.87	3.22
20	20.55	44.47	26.76	20.69	13.65	26.61	2.92	21.79	9.71	15.85	4.50
22	21.62	43.77	27.01	21.63	14.88	27.77	4.36	23.21	10.45	16.69	5.41
24	21.79	44.13	27.87	22.16	15.31	28.51	4.98	24.16	11.33	17.52	6.28
26	22.25	43.66	28.32	22.11	15.95			24.63	11.51	17.38	6.41
28	23.02	43.02	28.47	21.99				24.65	11.66	17.34	6.40
30											5.76
32											5.26
34											4.74
36											3.91
38											2.84

[1/] Production costs do not include stumpage or profit and risk.

Table 18 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 10 feet long, skidding distance is 100 feet, and slope zero.

Log Diameter Class	Cucumber			Black Gum			Hickory		Red Maple		
	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
10			$ -8.71			$ -27.58		$ -15.43			$ -19.11
12		$29.22	6.62		$ -1.44	- 7.67	$ 4.37	0.33		$ 9.60	0.13
14	$44.13	27.52	9.96	$ 9.26	4.01	- 0.30	10.15	6.42	$31.42	16.37	6.33
16	40.90	25.35	11.36	12.63	7.59	3.89	12.81	9.34	35.56	19.72	9.92
18	40.13	24.32	11.88	15.03	9.62	6.05	13.62	11.06	39.17	21.76	12.01
20	39.17	23.34	11.84	16 21	10.62	7.41	14.82	12.04	41.42	22.78	12.89
22	37.65	22.78	12.28	17.01	11.47	8.52	15.65	13.00	42.74	23.98	14.01
24	36.39	22.44	12.52	17.63	12.39	9.23	16.09	13.49	43.18	24.98	15.01
26	35.45	22.13	12.69	18.05	12.61	9.40	15.99	13.60	43.05	25.58	15.60
28							15.68	13.44	43.50	26.16	15.91
30									43.56	26.27	16.08
32									43.58	27.08	16.07

[1/] Production costs do not include stumpage or profit and risk.

Table 18 (Continued).--Margins between production costs[1/] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 10 feet long, skidding distance is 100 feet, and slope zero.

Log Diameter Class	Sugar Maple			Black Oak			Chestnut Oak				N. Red Oak	
	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs
10			$ -3.25			$ -22.33				$ -23.12		
12		$26.04	11.47		$ -1.06	- 6.14			$ 2.49	- 4.93		
14	$80.29	32.20	17.44	$12.15	4.30	- 1.28		$16.04	7.75	1.65		$40.93
16	71.59	35.35	19.79	17.61	7.66	2.42	$26.33	18.74	10.77	5.32	$46.75	40.77
18	68.50	37.27	21.47	22.28	9.11	4.83	28.24	20.28	12.83	8.01	46.41	41.24
20	66.17	38.02	22.14	25.05	10.35	6.35	29.84	21.14	14.69	9.88	47.72	42.03
22	64.76	38.51	22.66	26.85	11.82	7.41	31.86	22.50	16.30	11.82	48.63	42.78
24	63.38	39.20	22.90	27.37	12.63	7.89	32.95	23.29	17.06	12.42	49.46	43.59
26	62.46	39.45	23.42	27.80	13.34	8.86	33.96	23.39	17.65	12.74	49 64	43.90
28	62.42	40.73	23.69	28.20	13.79	9.52	34.67	25.04	18.19	13.41	50.26	44.58
30				28.24			35.56	25.22			51.28	45.29
32				28.24							51.44	45.38
34											50.66	44.8?
36											50.60	44.69
38											50 02	44.08
40											48.50	

[1/] Production costs do not include stumpage or profit and risk.

Table 18 (Continued).--Margins between production costs[1] and lumber value yields per M bd. ft., gross log scale, by species, log grade, and log diameter class, assuming each log is 10 feet long, skidding distance is 100 feet, and slope zero.

Log Diameter Class	N. Red Oak (Cont.)		Scarlet Oak		White Oak			Yellow-poplar			
	Grade 2 Logs	Grade 3 Logs	Grade 2 Logs	Grade 3 Logs	Select & Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
10		$ -11.55		$ -21.03			$ -15.49				$ 3.72
12	$ 9.36	5.39	$ 0.06	- 6.14		$15.12	- 4.37			$34.00	16.68
14	14.55	10.78	7.18	0.17	$32.92	17.22	1.56		$57.03	30.63	17.45
16	18.87	13.76	13.79	2.63	34.23	19.20	4.81	$54.85	51.13	29.76	18.51
18	21.02	15.32	14.32	4.19	35.96	21.32	6.86	51.46	48.44	29.62	19.44
20	23.35	16.68	16.29	5.44	38.87	23.23	8.65	49.50	45.75	28.97	19.65
22	25.37	17.56	17.54	7.07	41.14	25.22	10.08	48.13	45.21	28.94	19.91
24	26.46	18.58	18.15	7.81	42.93	25.29	10.83	46.72	44.30	28.70	20.39
26	27.62	18.91	18.76		43.94	26.17	11.22	46.07	44.15	28.89	20.53
28	28.78	19.62	19.18		44.47	27.12	11.06	45.97	43.28	29.15	20.93
30	28.97	20.00			45.78	27.77	10.93	45.98	42.74	28.73	20.84
32	28.97							45.40	43.13	29.06	21.10
34	28.95							46.56	42.40	28.67	
36								46.20	41.90	28.24	
38								45.39			
40								44.80			

[1] Production costs do not include stumpage or profit and risk.

Table 18.--Tree diameters at which total production costs equal value yield per M bd. ft., gross log scale [1] for standardized tree-log relationships [2] / skidding distance [3] / skidding slope [4] and log length, by species and log grade.

Species	16-Foot Logs				10-Foot Logs				Average Log Lengths			
	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
	(DBH in Inches)											
Ash			16	16			16	16			16	16
Basswood	[5] 20-	18-	16-	14-	20-	18-	16-	22	20-	18-	16-	16
Beech				14-				[6] 18				18
Black Birch			16-	25			16-	[6] 28+			16-	28+
Buckeye	20-	18-	17		20-	18-	22		20-	18-	21	
Black Cherry			17				20				20	
Chestnut		20	20	20		28	28	28		27	27	27
Cucumber		18-	16-	14-		18-	16-	24		18-	16-	22
Black Gum		18-	16-	17		18-	19	20		18-	18	20
Hickory			16-	14-			17	17			16-	17
Red Maple	20-	18-	16-	14-	20-	18-	16-	20	20-	18-	16-	19
Sugar Maple	20-	18-	16-	14-	20-	18-	16-	19	20-	18-	16-	18
Black Oak	20-	18-	16	19	20-	18-	21	26	20-	18-	20	24
Chestnut Oak	20-	18-	16-	17	20-	18-	18	22	20-	18-	17	21
N. Red Oak	20-	18-	16-	14-	20-	18-	18	20	20-	18-	17	19
Scarlet Oak			16-	17			17	22			17	21
White Oak	20-	18-	16-	20	20-	18-	16-	24	20-	18-	16-	24
Yellow-poplar	20-	18-	16-	14-	20-	18-	16-	19	20-	18-	16-	18

[1] Allowance for profit and risk is not included in costs of production.

[2] For 16-foot and 10-foot logs, the assumption is that each tree contains two logs of equal length. Average trees, however, contain a variable number of logs per tree and have variable log length.

[3] Skidding distance for 16-foot and 10-foot logs is standardized at 100 feet. For average logs and trees, the distance is 167 feet.

[4] Skidding slope for 16-foot and 10-foot logs is standardized at zero percent. For average logs and trees the slope is 30 percent.

[5] Whenever a minus sign follows a number, it indicates that value yield is greater than the costs of production at the smallest diameter recorded for the species and log grade -- 20 inches for select logs, 18 inches for grade 1, 16 inches for grade 2, and 14 inches for grade 3.

[6] Whenever a plus sign follows a number, it indicates that value yield is less than the costs of production at all sizes.

Table 20.--Log diameters at which total costs of production equal value yields per M bd. ft., gross log scale,[1] for standardized skidding distance[2], skidding slope[3], and log length[4], by species and log grade.

Species	16-Foot Logs				10-Foot Logs				Average Log Lengths			
	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
	(Log Diameter in Inches)											
Ash			16	10-			12	12			11	11
Basswood	[5] 16-	14-	12-	10-	16-	14-	12-	13	16-	14-	12-	13
Beech			12-	10-				13				13
Black Birch			12-	14			12-	[6] 24+			12-	24+
Buckeye	16-	14-	12-		16-	14-	16		16-	14-	15	
Black Cherry			12				16				16	
Chestnut		15	15	15		21	21	21		21	21	21
Cucumber		14-	12-	10-		14-	12-	21		14-	12-	17
Black Gum		14-	12-	12		14-	13	16		14-	13	17
Hickory			12-	10-			12-	13			12-	13
Red Maple	16-	14-	12-	11	16-	14-	12-	15	16-	14-	12-	14
Sugar Maple	16-	14-	12-	10-	16-	14-	12-	14	16-	14-	12-	13
Black Oak	16-	14-	12-	14	16-	14-	15	19	16-	14-	14	18
Chestnut Oak	16-	14-	12-	12	16-	14-	13	16	16-	14-	13	16
N. Red Oak	16-	14-	12-	11	16-	14-	13	15	16-	14-	13	15
Scarlet Oak			12-	11			13	16			13	15
White Oak	16-	14-	12-	15	16-	14-	12-	21	16-	14-	12-	21
Yellow-poplar	16-	14-	12-	10-	16-	14-	12-	15	16-	14-	12-	14

[1] Allowance for profit and risk is not included in costs of production.

[2] Skidding distance for 16-foot and 10-foot logs is standardized at 100 feet. For average logs, the distance is 167 feet.

[3] Skidding slope for 16-foot and 10-foot logs is standardized at zero percent. For average logs, the slope is 30 percent.

[4] Average log length varies from 11.3 feet at a diameter of 8 inches to 12.8 feet at 20 inches and remains constant thereafter.

[5] Whenever a minus sign follows a number, it indicates that value yield is greater than the costs of production at the smallest diameter recorded for the species and log grade -- 16 inches for select logs, 14 inches for grade 1, 12 inches for grade 2, and 10 inches for grade 3.

[6] Whenever a plus sign follows a number, it indicates that value yield is less than the costs of production at all sizes.

Costs and Returns Under Variable Conditions

Marginal log and tree sizes were indicated in tables 19 and 20 under the assumption that each tree contained two logs of equal length, skidding distance was 100 feet, and slope was zero. These margins are affected, of course, by changes in the assumptions regarding cost.

If, instead of 2-log trees, the analysis is applied to 1-log trees, costs are increased ranging from $0.77 to $2.81 per M bd. ft. On the other hand, a change from 2-log trees to 3-log trees reduces costs ranging from $0.23 to $0.66. Increase in slope does not affect costs strongly. E.g., to skid logs from 24-inch trees 100 feet on a 60 percent slope raises costs only $0.91 per M bd. ft. above the costs for the same distance on a zero slope. Skidding distance, however, has a more profound influence on costs. On level ground, skidding costs for logs from 24-inch trees increase $5.28 per M bd. ft. when the skidding distance is increased from 100 to 400 feet and $12.07 when the distance is increased from 100 to 800 feet.

The effect of some of the possible changes in cost conditions on marginal tree and log sizes is shown in tables 21 to 24. These tables represent only a few of the possible combinations of costs and returns under which marginal sizes of trees and logs can be determined. Other comparisons of logging and milling costs and returns can be made easily from the mass of data presented in this series of technical notes.

Table 21.--Tree diameters at which total production costs equal value yields per M bd. ft., gross log scale,[1] for variable skidding distance and slope and trees containing two 16-foot logs, by species and log grade.

Species	ZERO SLOPE								60 PERCENT SLOPE							
	Distance - 400 Feet				Distance - 800 Feet				Distance - 100 Feet				Distance - 400 Feet			
	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
Ash			16	16			18	18			16-	14-			17	17
Basswood	[2]/ 20	18-	16-	14-	20-	18-	16-	20	20-	18-	16-	14-	20-	18-	16-	19
Beech				17				21				14-				20
Black Birch			16-	[3]/ 28+			16-	28+			16-	28+			16-	28+
Buckeye	20-	18-	21		19	19	30		20-	18-	17		20-	18-	32+	
Black Cherry			20				26				17				28	
Chestnut		27	27	27		42+	42+	42+		21	21	21		18-	42+	42+
Cucumber		18-	16-	20		18-	16-	30+		18-	16-	14-		18-	16-	30+
Black Gum		18-	17	19		19	21	25		18-	16-	17		18-	19	23
Hickory			16-	17			19	20			16-	14-			17	19
Red Maple	20-	18-	16-	19	20-	18-	17	21	20-	18-	16-	14-	20-	18-	16-	21
Sugar Maple	20-	18-	16-	17	20-	18-	16-	22	20-	18-	16-	14-	20-	18-	16-	21
Black Oak	20-	18-	20	24	20-	18-	24	32+	20-	18-	16-	20	20-	18-	23	30
Chestnut Oak	20-	18-	17	21	20-	18-	21	31	20-	18-	16-	18	20-	18-	17	27
N. Red Oak	20-	18-	18	20	20-	18-	38+	34+	20-	18-	16-	14-	20-	18-	19	23
Scarlet Oak			16-	21			19	28+			16-	17			18	26
White Oak	20-	18-	16-	24	20-	18-	17	34+	20-	18-	16-	20	20-	18-	16-	34+
Yellow-poplar	20-	18-	16-	14-	20-	18-	16-	30	20-	18-	16-	14-	20-	18-	16-	22

[1]/ Allowance for profit and risk is not included in costs of production.

[2]/ Whenever a minus sign follows a number, it indicates that value yield is greater than the costs of production at the smallest diameter recorded for the species and log grade -- 20 inches for select logs, 18 inches for grade 1, 16 inches for grade 2, and 14 inches for grade 3.

[3]/ Whenever a plus sign follows a number, it indicates that value yield is less than the costs of production at all sizes.

Table 22.--Tree diameters at which total production costs equal value yields per M bd. ft., gross log scale,[1] for variable skidding distance and slope and trees containing two 10-foot logs, by species and log grade.

Species	ZERO SLOPE								60 PERCENT SLOPE							
	Distance - 400 Feet				Distance - 800 Feet				Distance - 100 Feet				Distance - 400 Feet			
	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
Ash			19	19			25	25			17	17			21	21
Basswood	[2] 20-	18-	16-	20	20-	18-	25	32+	20-	18-	16-	19	20-	18-	18	32+
Beech				21				25				19				23
Black Birch			16-	28+			19	28+			16-	28+			17	28+
Buckeye	19	19	28		24	24	32+		20-	18-	22		21	21	32+	
Black Cherry			27				32+				20				32+	
Chestnut		[3] 42+	42+	42+		42+	42+	42+		36	36	36		42+	42+	42+
Cucumber		18-	16-	30+		18-	21	30+		18-	16-	28		18-	18	30+
Black Gum		19	21	25		24	30+	30+		18-	19	21		21	26	30+
Hickory			19	20			24	28			17	18			21	23
Red Maple	20-	18-	18	24	20-	18-	23	33	20-	18-	17	20	20-	18-	19	29
Sugar Maple	20-	18-	16	22	20-	18-	19	30+	20-	18-	16-	19	20-	18-	17	27
Black Oak	19	19	25	31	22	22	32+	32+	20-	18-	22	26	21	21	29	32+
Chestnut Oak	20-	18-	22	30	20-	22	27	32+	20-	18-	19	23	20-	19	23	32+
N. Red Oak	20-	18-	21	25		18-	38+	34+	20-	18-	19	20	20-	18-	23	32
Scarlet Oak			20	28+			24	28+			18	23			21	28+
White Oak	20-	18-	18	34+	20-	18-	23	34+	20-	18-	16-	26	20-	18-	20	34+
Yellow-poplar	20-	18-	16-	28	20-	18-	23	36+	20-	18-	16-	20	20-	18-	19	36+

[1] Allowance for profit and risk not included in costs of production.

[2] Whenever a minus sign follows a number it indicates that value yield is greater than the costs of production at the smallest diameter recorded for the species and log grade -- 20 inches for select logs, 18 inches for grade 1, 16 inches for grade 2, and 14 inches for grade 3.

[3] Whenever a plus sign follows a number it indicates that value yield is less than the costs of production at all sizes.

Table 23.--Log diameters at which total production costs equal value yields per M bd. ft., gross log scale,[1] for 16-foot logs and variable skidding distance and slope, by species and log grade.

Species	ZERO SLOPE								60 PERCENT SLOPE							
	Distance - 400 Feet				Distance - 800 Feet				Distance - 100 Feet				Distance - 400 Feet			
	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
Ash			12-	10-			13	13			12-	10-			11	11
Basswood	[2]16-	14-	12-	11	16-	14-	12-	15	16-	14-	12-	10-	16-	14-	12-	13
Beech				11				15				10-				13
Black Birch			12-	[3]24+			12-	24+			12-	24+			12-	24+
Buckeye	16-	14-	15		15	15	28+		16-	14-	12-		16-	14-	19	
Black Cherry			15				28+				13				19	
Chestnut		19	19	19		38+	38+	38+		15	15	15		38+	38+	38+
Cucumber		14-	12-	15		14-	12-	26+		14-	12-	11		14-	12-	26+
Black Gum		14-	12-	15		14-	15	19		14-	12-	13		14-	15	19
Hickory			12-	11			13	15			12-	10-			12-	14
Red Maple	16-	14-	12-	13	16-	14-	13	17	16-	14-	12-	11	16-	14-	12-	15
Sugar Maple	16-	14-	12-	12	16-	14-	12-	17	16-	14-	12-	10-	16-	14-	12-	15
Black Oak	16-	14-	13	17	16-	14-	19	28+	16-	14-	12-	15	16-	14-	17	27
Chestnut Oak	16-	14-	12-	15	16-	14-	15	19	16-	14-	12-	13	16-	14-	13	17
N. Red Oak	16-	14-	12-	13	16-	14-	15	20	16-	14-	12-	11	16-	14-	13	18
Scarlet Oak			12-	14			13	24+			12-	11			13	21
White Oak	16-	14-	12-	21	16-	14-	12-	30+	16-	14-	12-	15	16-	14-	12-	30+
Yellow-poplar	16-	14-	12-	11	16-	14-	12-	32+	16-	14-	12-	10-	16-	14-	12-	32+

[1] Allowance for profit and risk not included in costs of production.

[2] Whenever a minus sign follows a number, it indicates that value yield is greater than the costs of production at the smallest diameter recorded for the species and log grade -- 16 inches for select logs, 14 inches for grade 1, 12 inches for grade 2, and 10 inches for grade 3.

[3] Whenever a plus sign follows a number, it indicates that value yield is less than the costs of production at all sizes.

Table 24.--Log diameters at which total production costs equal value yields per M bd. ft., gross log scale,[1] for 10-foot logs and variable skidding distance and slope, by species and log grade.

Species	ZERO SLOPE								60 PERCENT SLOPE							
	Distance - 400 Feet				Distance - 800 Feet				Distance - 100 Feet				Distance - 400 Feet			
	Select Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs	Sel. Logs	Grade 1 Logs	Grade 2 Logs	Grade 3 Logs
Ash			13	13			19	19			11	11			16	16
Basswood	[2]16-	14-	12-	15	16-	14-	13	23	16-	14-	12-	13	16-	14-	12-	19
Beech				15				21				13				19
Black Birch			12-	24+			15	24+			12-	24+			12-	24+
Buckeye	15	15	23		17	17	28+		16-	14-	17		15	15	28+	
Black Cherry			28+				28+				17				28+	
Chestnut		[3]38+	38+	38+		38+	38+	38+		23	23	23		38+	38+	38+
Cucumber		14-	12-	26+		14-	14	26+		14-	12-	26+		14-	12-	26+
Black Gum		14-	17	19		17	23	26+		14-	13	15		15	19	25
Hickory			13	15			19	21			12-	13			15	17
Red Maple	16-	14-	13	18	16-	14-	17	27	16-	14-	12-	13	16-	14-	15	23
Sugar Maple	16-	14-	12-	17	16-	14-	12-	28+	16-	14-	12-	13	16-	14-	13	24
Black Oak	16-	14-	19	26	17	17	27	28+	16-	14-	15	19	15	15	26	28+
Chestnut Oak	16-	14-	15	19	16-	15	20	28+	16-	14-	13	15	16-	14-	19	22
N. Red Oak	16-	14-	15	20	16-	14-	19	30+	16-	14-	13	15	16-	14-	17	27
Scarlet Oak			15	21			17	24+			13	17			15	24+
White Oak	16-	14-	12-	30+	16-	14-	12-	30+	16-	14-	12-	22	16-	14-	15	30+
Yellow-poplar	16-	14-	12-	32+	16-	14-	19	32+	16-	14-	12-	17	16-	14-	12-	32+

[1] Allowance for profit and risk not included in costs of production.

[2] Whenever a minus sign follows a number, it indicates that value yield is greater than the costs of production at the smallest diameter recorded for the species and log grade -- 16 inches for select logs, 14 inches for grade 1, 12 inches for grade 2, and 10 inches for grade 3.

[3] Whenever a plus sign follows a number, it indicates that value yield is less than the costs of production at all sizes.